Exposure to Lead at Firing Ranges in Stuttgart

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Outline

- Background
- Exposures
- Laws and regulations
- Health effects and concerns
- Surveillance and monitoring
- Future directions
- Conclusions

History

- 1999: Industrial hygiene approached to survey ranges to assess health risks
- 2000: Old shoot house demolished, new one constructed at range complex
- 2003: Overexposures to silica and lead noted in **outdoor** firing ranges
- 2004: Sand in outdoor ranges changed
- Feb 2004: DoD Lead (and Depleted Uranium) Biomonitoring Policies

Exposure at Firing Ranges

- Biggest concerns at ranges
  - Getting shot
  - Avoiding shooting other persons
  - Hitting the target
  - Lead and noise exposure
- Sources of lead
  - Projectile, primer, lead dust and fume, lead residue, and contamination, fragmentation
  - Ingestion and inhalation
- Unique features
  - Unit
  - Range

1/10 Special Forces Group

- Based in Stuttgart, Germany
- 3 companies of about 70 soldiers each
  - A, B company fire approximately 1X/week
  - C company fire approximately 4-5X/week
  - HQ element (100 or so) fire just a few times per year
- All elements fire several hundred rounds when at the range; no set ammunition limits
- Unique within Special Operations community?
  - “We fire more than anyone in the Army except Delta”

The Ranges

- The old shoot house
- Current range complex
  - New shoot house
  - Outdoor ranges 1-5
- Under construction—newer shoot houses
- Indoor firing range

“The Old Shoot House”

- Bldg 2916, now parking lot of elementary school, literally adjacent to, within 100 meters of the school
- Where initial exposures occurred
- Primary source of overexposure primer and other explosives composed of >90% lead
- Sampled for lead paint—none found
- Demolished 2001

New Shoot House

- Main current source of overexposure
- Primary source is lead explosives
- Poor ventilation
- Extreme, heavy use

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Outdoor Firing Ranges

- Tunnel comprises much of the range
  - Smoke accumulation
  - Air trapping
- Pulverized sand
  - Heavy use
  - Lack of scheduled sand replacement
  - Delay in replacing due to Hazardous waste disposal
- Current situation:
  - All sand recently replaced, overexposures not as likely
  - Constant vigilance

Exposure Laws and Regulations

- 29 CFR 1926.62
  - Permissible exposure limit (PEL) of 50 ug/m^3 based on an 8 hour time-weighted average (TWA), action level 30 ug/m^3 (EPA 1.5 ug/m^3)
  - Respirator supplementation required
- Medical surveillance requirements
  - Initial monitoring for blood lead level (BLL) and ZPP "shall be provided to employees exposed to lead at or above the action level on any one day"
  - An initial medical examination is to be given to all employees prior to their assignment to an area in which airborne lead concentrations reach or exceed 30 ug/m^3 for more than 30 days per year
    - Required testing of BLL at least every 2 months for the first 6 months and every 6 months thereafter
    - Frequency is increased if BLL > 40, requires written notification and exam
    - Removal from work required if BLL > 50
  - Employers required to inform all workers of the standard, purpose, and description of medical surveillance and provisions for medical removal, as well as health effects
- National Health Objective 2010 (No. 20-07): No BLL >25

Industrial Hygiene

- Shoot house surveys
- Outdoor ranges surveys
- Are these exposures really unique within the SOF community?
- Are these exposures unique within the military community? (Other special populations—EOD, Navy seals, etc)

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Occupational Health

- Surveillance done since 1999, every 6 months
  - No KNOWN health outcomes
  - C Company only
- Medical surveillance required by OSHA
  - Lead expected to stay above PEL
  - Enrolls soldiers exposed 30 days/year in medical surveillance
  - Baseline exams and monitoring (if BLL <40)
- Methods to incorporate
  - Initial SF physical and lab work
  - In processing
  - Occupational Health tracking for 6 month follow-up

Other Exposure Sources

- Drinking water contamination
- Lead-soldered food cans (until 1980s)
- Ceramic tableware, glazed pottery, crystal glassware, “natural” calcium supplements, bright red and yellow paints on bread bags, moonshine
- Hobbies (as above)
- House renovation
- Asian cosmetics
- “Home” remedy medicines from Mexico, Asia, and the Middle East
- Cigarettes contain small amounts of lead

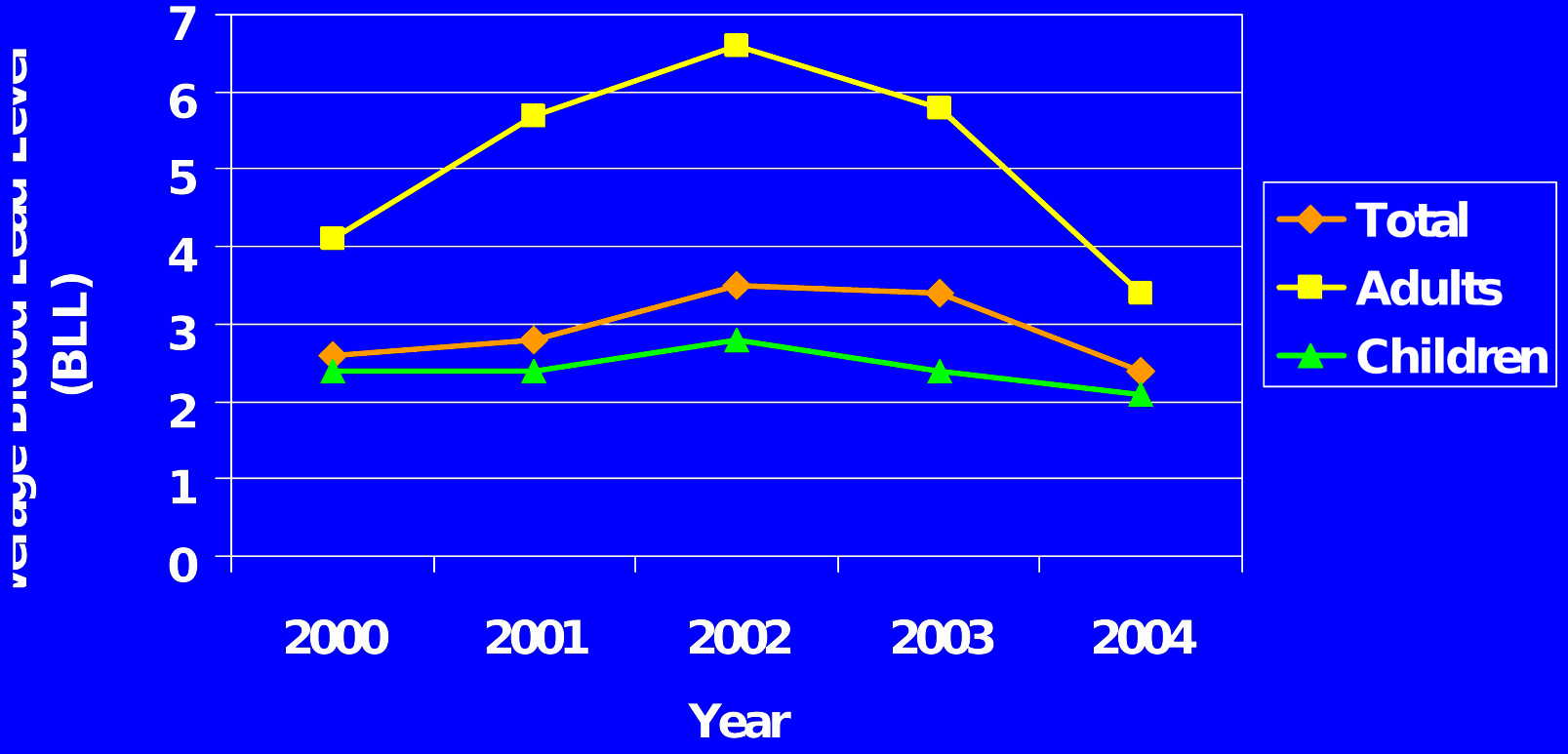
Surveillance and Monitoring

- BLL—most useful test for recent or ongoing exposure
- ZPP—not as sensitive as BLL at levels below 30 ug/dL, not as specific to lead, and a 120 day lag time
- Blood counts (anemia) and urine and blood tests for kidney function

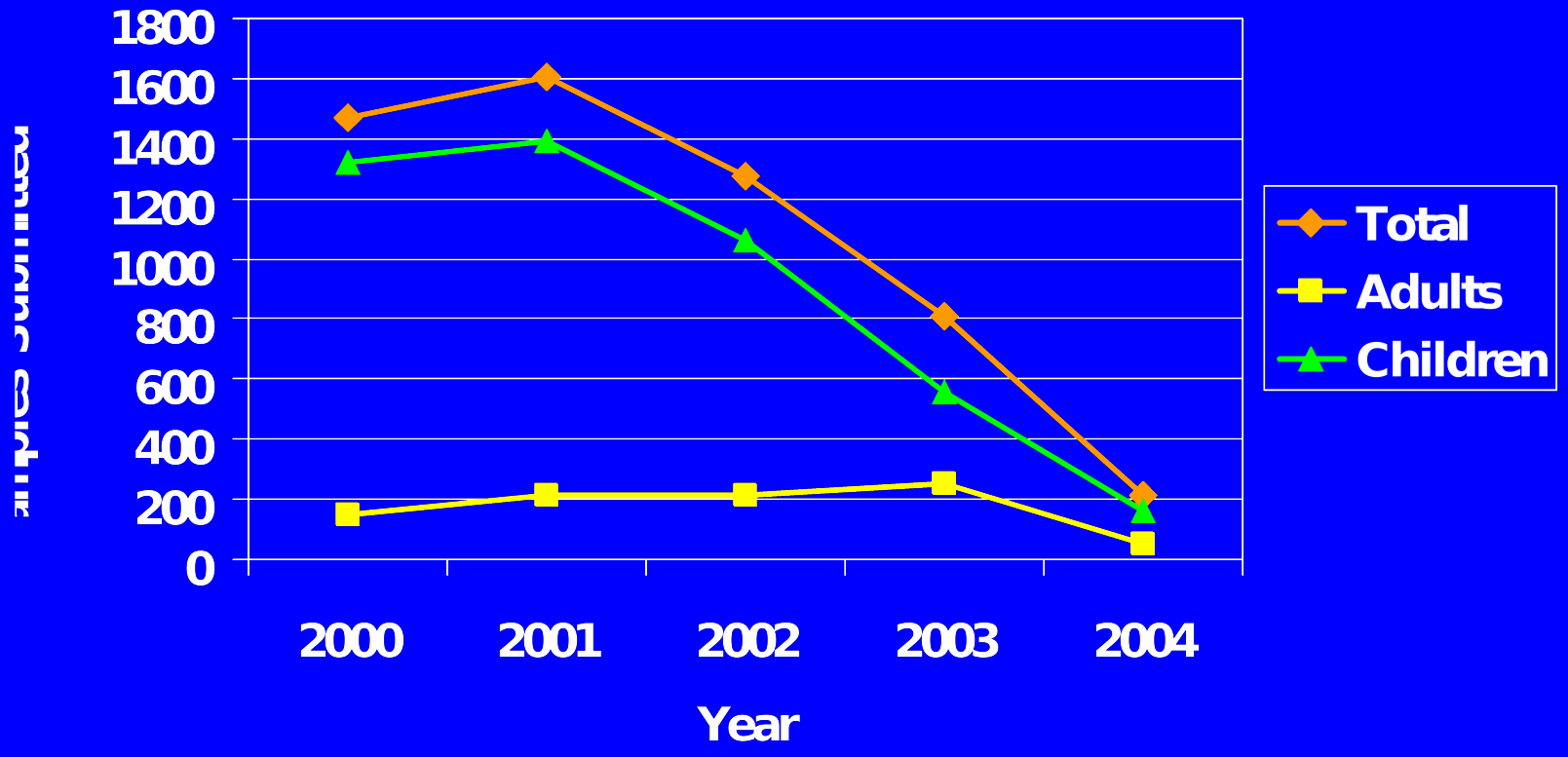
Epidemiology Questions

- Health outcomes
- Risk factors for overexposure
  - MOS, demographics
  - Number of days at range, rounds fired, shoot house
  - Respiratory protection
  - TDY, Deployment
- Trends in BLL over time (different soldiers)
- Trends in BLL over time (same soldiers—cohort)
- Lead exposures in children and adults in Europe

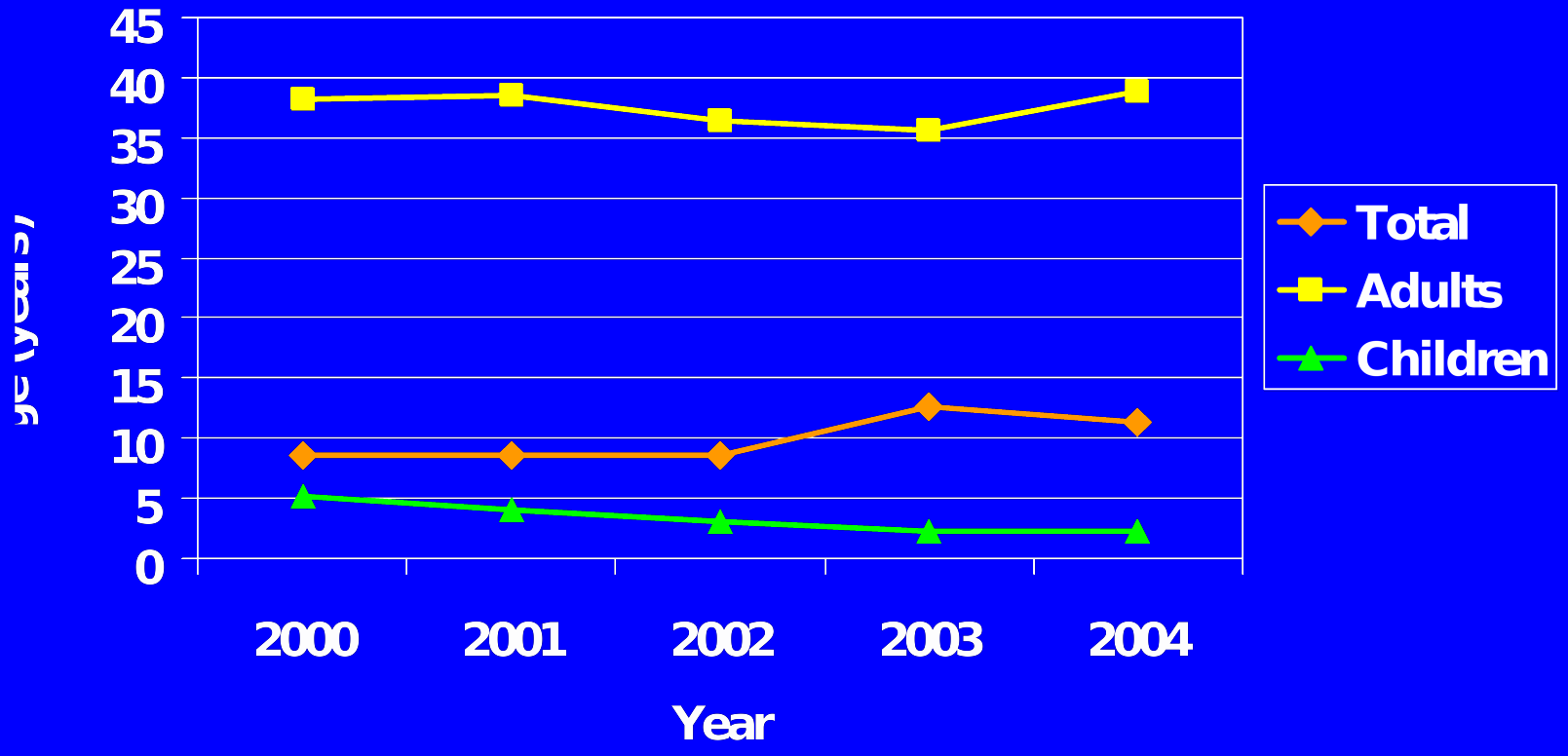
Blood Lead Surveillance in Europe, 2000-2004



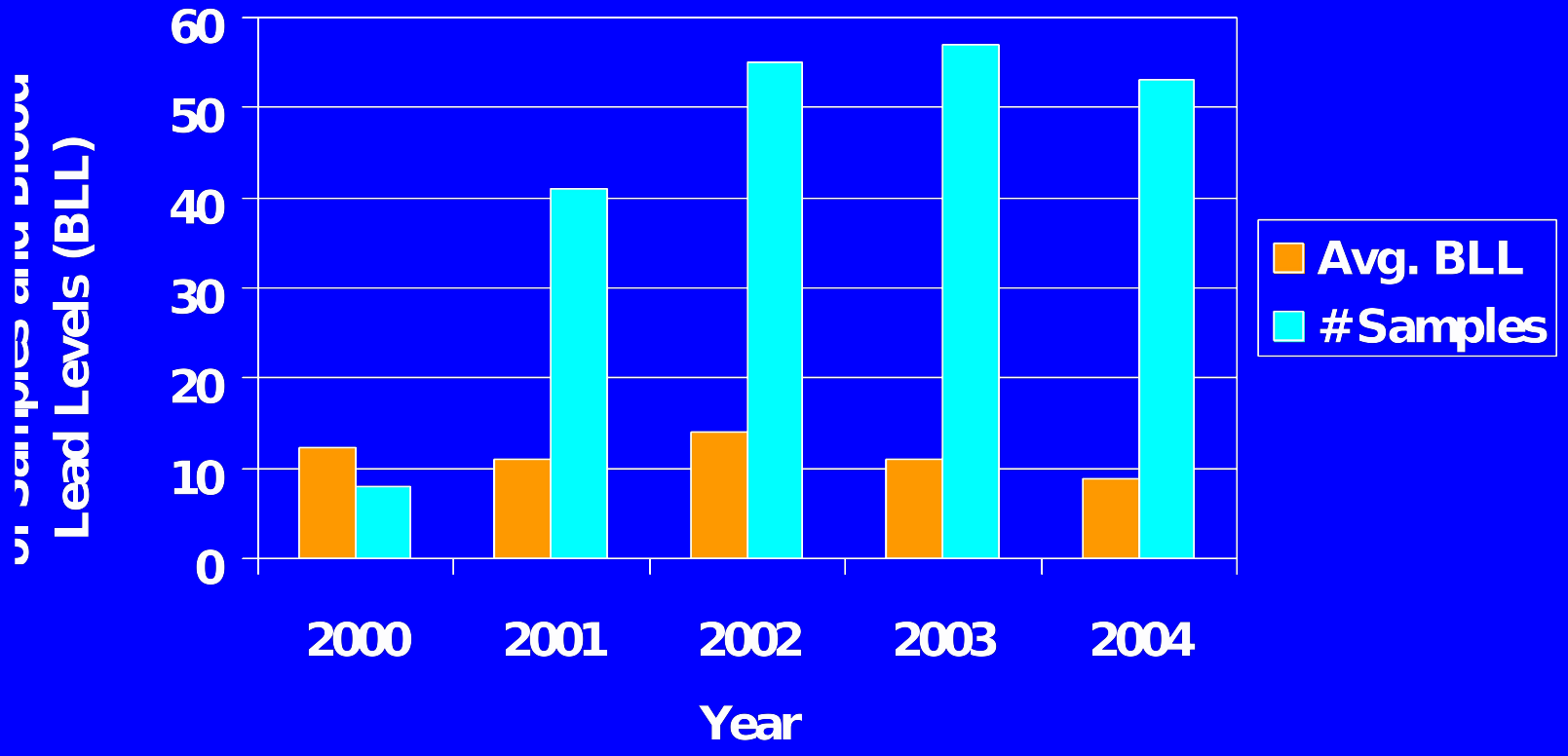
Lead Samples Submitted in Europe, 2000-2004



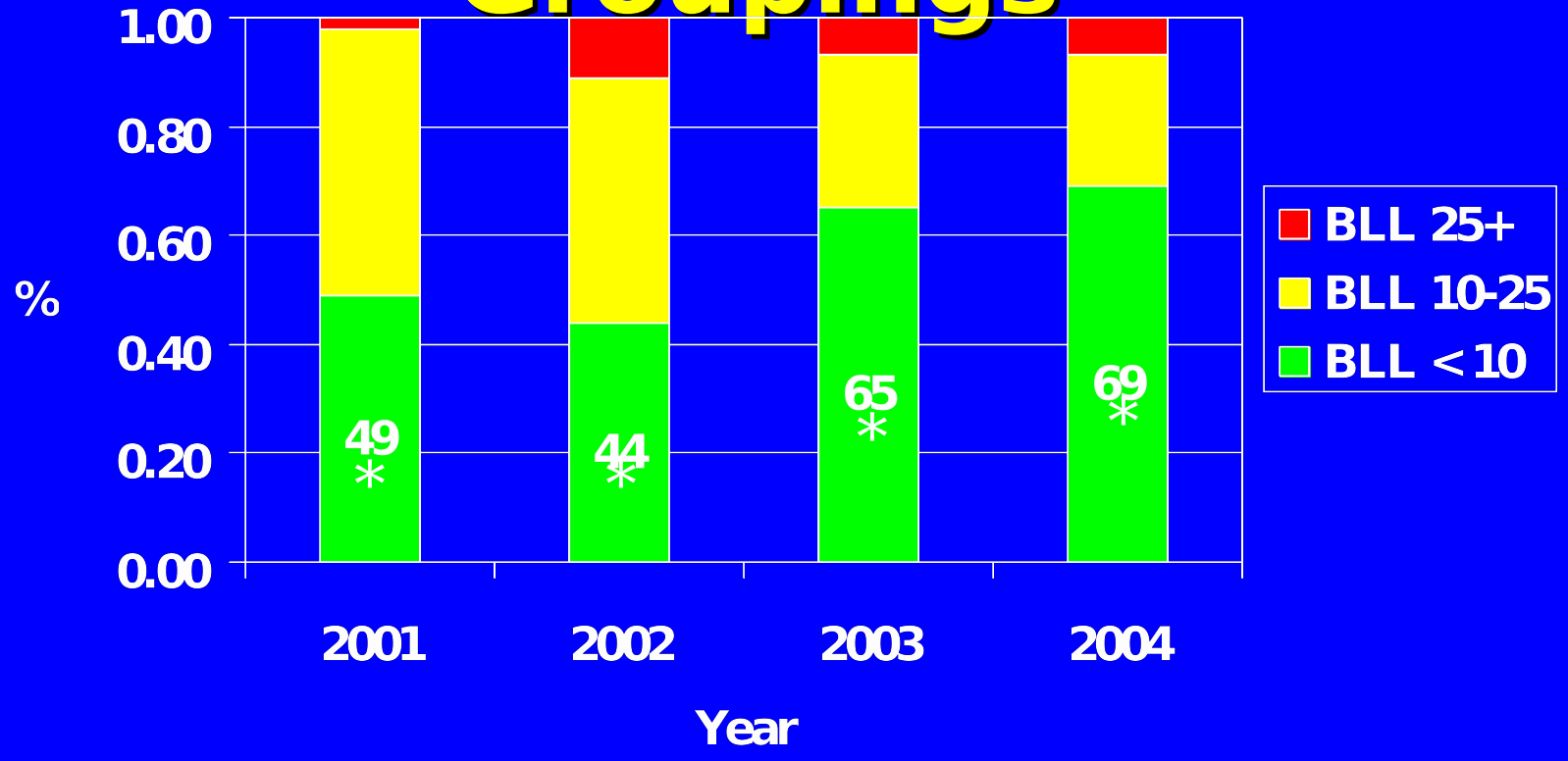
Average Age of Samples Submitted for Lead Testing, 2000-2004



Lead Levels at Special Forces Unit in Stuttgart, 2000-2004



Trends in BLL Among SF Soldiers at C 1/10 SF By Significant Lead Groupings



*Chi-square (trend)= 7.0, p=0.008

N=41 (2001), 55 (2002), 57 (2003), 54 (2004)

Soldiers Undergoing Repeat Testing for BLL: Paired t-tests

Comparison	#	BLL change	P-value
2001-02	21	3.2	0.055
2002-03	27	-5.6	0.002
2003-04	23	-4.3	0.001
01 to 04	5	-8.4	0.016
02 to 04	11	-11.1	0.001

Discussion

- Lead testing among children no longer common in Europe
  - Lead overexposures not common
  - Older housing, pipes gone
- Significant change in Stuttgart SF soldiers' lead levels with education, PPE, and other controls in place
- Difficult to coordinate testing or further analysis due to mission constraints
- Likely exposures at other SF training areas

Conclusions

- Exposures fairly well-characterized locally
- Although there have been no known health effects seen, limited data exists on outcomes, mainly BLL and ZPP
- Within reasonable limits, OSHA-required surveillance and communication is the right thing to do, and should be carefully monitored
- System-wide (SOF) data and comprehensive approach to lead exposure appears to be lacking

Future Directions

- Improved documentation and surveillance compliance, IAW DoD Biomonitoring Policy
- Continued attempts to engineer out lead exposure
- Continued air sampling by industrial hygiene
- Epidemiologic analysis of risk factors for higher lead levels
- Continued epidemiologic review of surveillance data